Introduction to Homeostasis

Homeostasis:  
-maintenance of a constant internal environment despite changes in the external environment.  
Ex: Body temperature does not fluctuate with environmental temperature.  
-these constant conditions are maintained through a series of monitored adjustments; monitoring and feedback happens at all times.  
Ex: normal constant blood sugar level 🡪 0.01% glucose  
 blood pH 🡪 7.4

Page 335 shows how strict these limits/ranges are

How does the monitoring and feedback happen?  
There are 3 main components to homeostatic maintenance

1. Monitor (Sensor)  
   -senses that conditions are outside of the normal limits.  
   -sends message to corresponding center.
2. Coordinating sensor  
   -relays information from monitor to regulator.
3. Regulator  
   -restores normal balance.

See page 339

Negative feedback🡪 opposite direction  
pH goes high; bring it back down.   
-not ‘bad’ feedback; it just means that it acts opposite to current changes in the body  
>1000 of all feedback loops are negative feedback  
-prevents small changes from becoming large ones  
-Ex: temperature regulation

Positive feedback🡪 same direction  
childbirth- contractions are not normal function, but the body increases the intensity and the duration; the contractions initiate oxytocin(hormone) which initiates larger contractions until the baby is born.  
-these systems reinforce a change from the normal range  
-less common

Thermoregulation

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| Endotherms (Ex mammals) | Ectotherms (Ex reptiles/fish) |
| maintain constant temperature despite environment | use air temperature to regulate body temperature and metabolism |
| hypothalamus (brain) is our thermostat | some use sun/shade |

Hypothermia:  
-body core temperature falls below normal range  
-heart rate slows and blood is diverted to the brain and other vital organs to conserve heat  
-could lead to coma/death

The Urinary System

3 Main stages to form urine:

1. Filtration:   
   Works like a sieve; discrimination based on size: small things pass through, large things (blood cells, plasma proteins, platelets) are held back. Molecules that we need, like salt and glucose also pass through because they are really small. This poses a problem.
2. Reabsorption:   
   Our body takes back the things it still requires: salts, glucose, fluids. About 600mL of fluid flows through the kidneys every minute. Only 1mL of urine is formed for every 120mL of fluids filtered into the nephron. The remaining 119mL is reabsorbed.   
   Threshold level: maximum amount of material that can be moved across the nephron.   
   Descending loop of Henle: Water is reabsorbed.  
   Ascending loop of Henle: Salts are reabsorbed.
3. Secretion 🡪 movement of wastes from the blood into the nephron.   
   Distal tubules: Secretion of wastes using active transport.

- Urine formation depends on filtration, reabsorption and secretion.   
- The glomerulus acts as a high pressure filter.   
- Selective reabsorption occurs by both active and passive transport.   
- Secretion is the movement of wastes from the blood to the nephron.   
  
Importance of excreting wastes:

- The kidneys filter wastes from the blood.  
- The liver helps to eliminate toxic nitrogenous groups from the body by deamination.  
- Land animals produce urea.  
- Larger, more complex animals generate more wastes; they have specialized cells that allow more efficient waste removal.

From section 7.3

Deamination:  
-removal of an amino acid group from an organic compound.   
-occurs in the liver.  
-buildup of ammonia is extremely poisonous; this is a problem because we can’t get rid of it immediately like unicellular organisms.

Urea:  
-nitrogen waste formed from two molecules of ammonia and one molecule of CO2.  
-100,000 times less toxic than ammonia.  
-blood can dissolve 33mg of urea per 100mL of blood.

Uric Acid 🡪 waste product formed from break down of nucleic acids.

-Kidneys help maintain water balance (important because humans cannot survive without water even for a few days. Humans lose 2L of water every day on average through perspiration, urine and exhaled air.)

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| Waste | Origin of waste | Organ of excretion |
| Ammonia | Deamination of amino acids by the liver | Kidneys |
| Urea | -Deamination of amino acids by the liver -Ammonia combined to CO2 | Kidneys |
| Uric acid | Product of breakdown of nucleic acids like DNA | Kidneys |
| CO2 | Waste product of cellular respiration (Krebs Cycle) | Lungs |
| Bile pigments | Breakdown of RBC pigment and hemoglobin | Liver |
| Lactic acid | Product of anaerobic respiration | Liver |
| Solid waste | byproduct of digestible and indigestible material | Large Intestine |

-Contractile Vacuole: a structure in unicellular organisms that maintain osmotic equilibrium by pumping fluids out of the cell.

From section 7.4

Ureters: tubes that conduct urine from the kidneys to the bladder.  
Urethra: tube that carries urine from the bladder to the exterior of the body.   
Cortex: outer layer of the kidney.  
Medulla: area inside the cortex.  
Renal pelvis: area where the kidney joins the ureter.  
Urinary sphincters: help an organism have voluntary control over the release of urine.   
Nephrons: functional units of the kidneys 🡪 millions of nephrons in our body.  
Afferent arterioles: small branches that carry blood to the glomerulus.